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# Safety and Mission Assurance Requirements

## Assurance Management Office

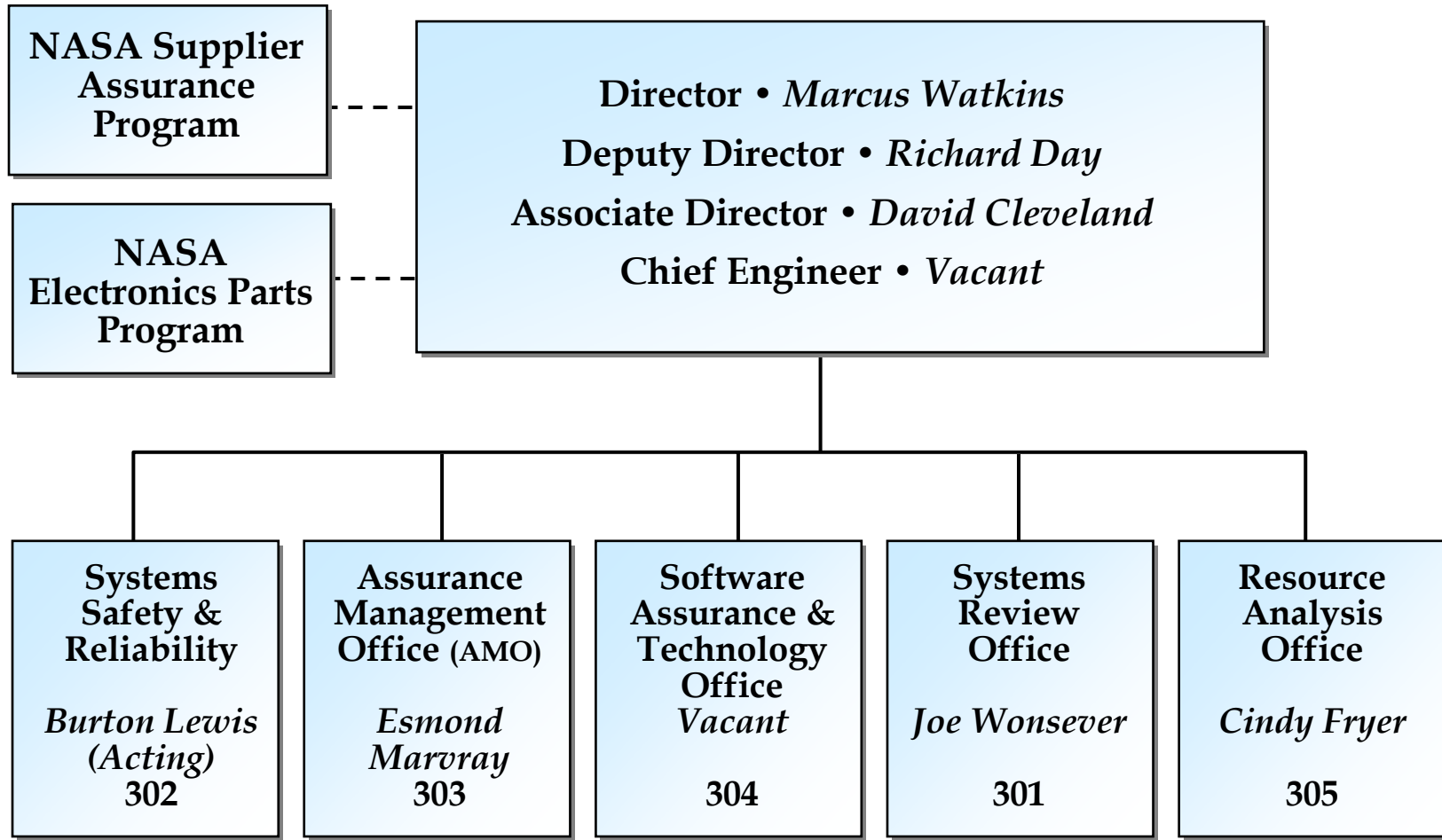
September 2006

Presented By:  
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Chief, Assurance Management Office



# Office of Systems Safety and Mission Assurance

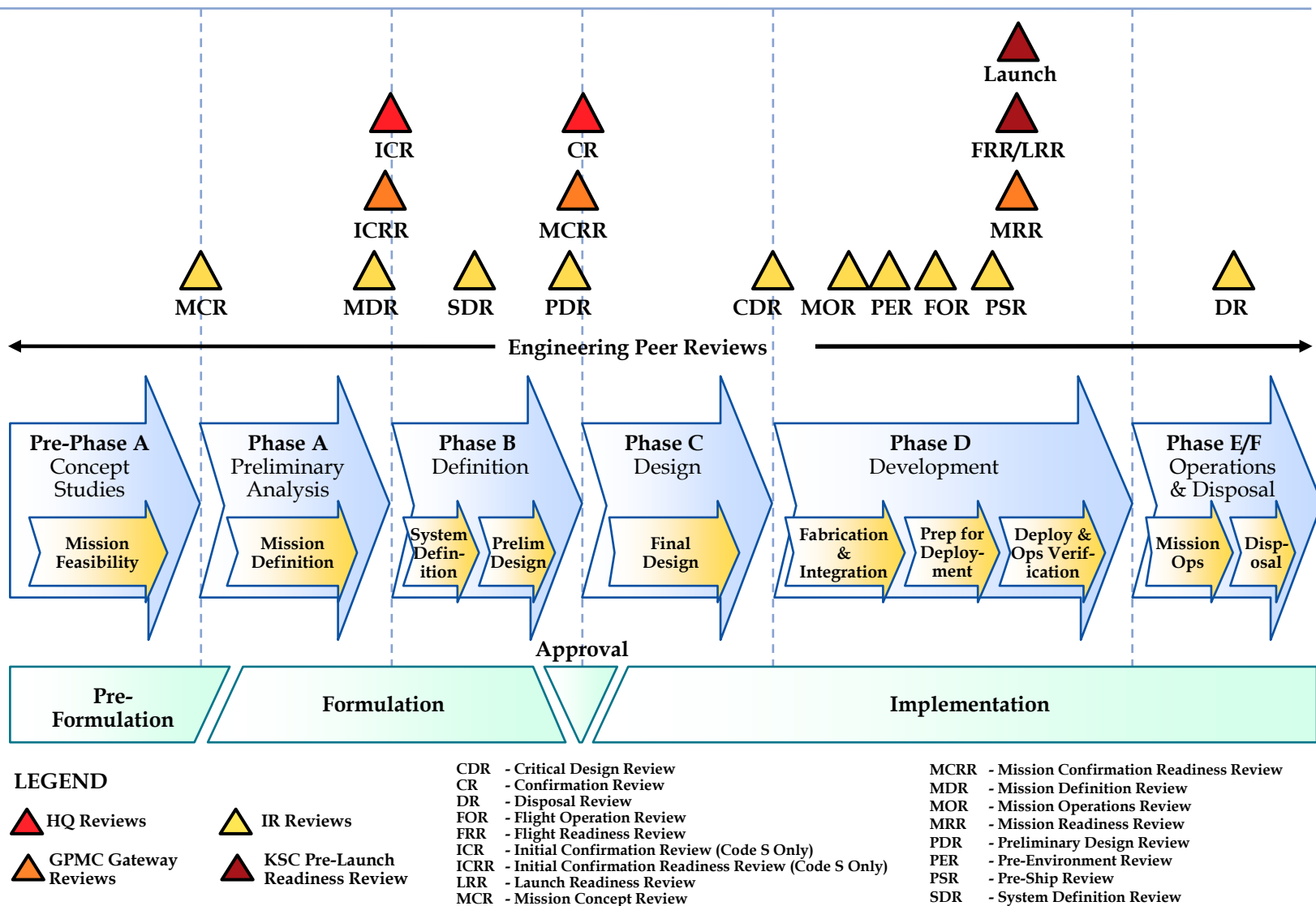
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# Project Life Cycle Overview

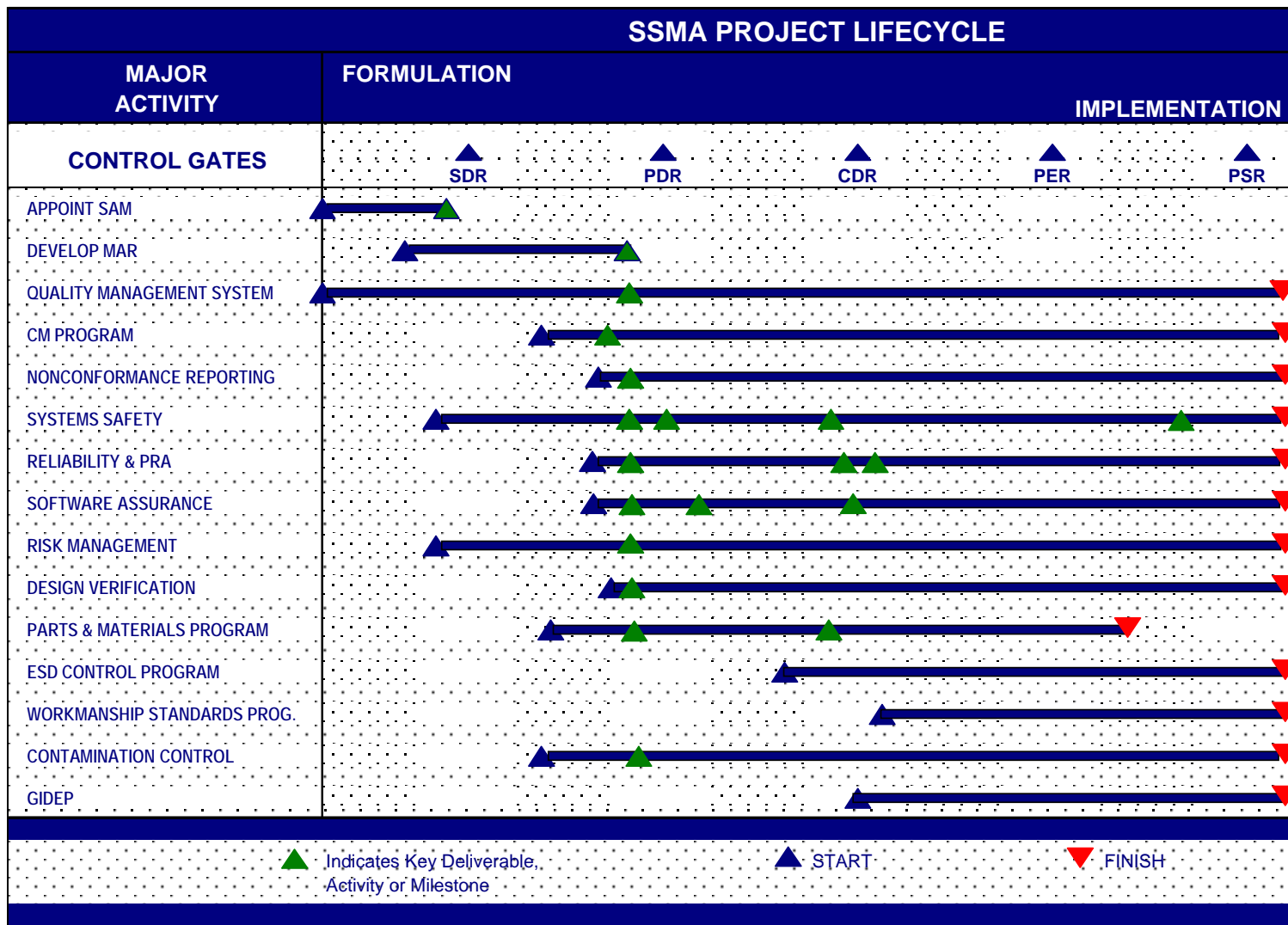
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# Approach to Life Cycle Implementation of SSMA

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# *Safety and Mission Assurance Approach*

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- Systems Assurance Manager (SAM) assigned to Project
  - SAM works w/Project to develop Mission Assurance Requirements (MAR).
  - SAM is the single point of contact for project Systems Safety & Mission Assurance (SS&MA) activities.
  - SAM is generally co-located with the project office and functions as a member of the management team with an independent reporting path.
- SAM Responsibilities
  - Responsible for development of Mission Assurance Requirements (MARs) for each project the Assurance Management Office (AMO) supports.
  - Ensures implementation of the (MAR).
  - Complements the Systems Review Office (SRO) and systems managers for completion of mission success activities.
  - Coordinate risks and issues with the Systems Review Manager both before and after major reviews.
  - Ensures that appropriate Assurance Oversight/Insight of contractors is in place.
  - SAM signs off on all project problem reports, failure reports, waivers/deviations and design changes.



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- The SAM develops the MAR using the Mission Assurance Guidelines (MAG) and inputs from the Systems Safety and Quality Assurance (SSMA) team. This team will consist of representatives from the following organizations:
  - Contamination/Code 545
  - Materials/Code 541
  - Parts/Code 562
  - Radiation/Code 561
  - Reliability/Code 302
  - Risk Management/Code 170 (merging into Code 300)
  - Safety/Code 302
  - Software and Hardware QA/Code 303
  - Systems Review Office/Code 301
- The MAR contents are tailored from all sections of the MAG.
- The SAM prepares a Summary Report that includes the name and concurrence of the team member for each section and any deviations from the standard requirements in the MAG with a detailed explanation of the deviation.



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- After completing the Summary Report the SAM schedules a 2 hr. meeting with Code 300 management to review the Draft MAR and the Summary Report. The meeting attendees include at least one member of the directorate office, all Technical Chiefs of the Directorate, the SAM, a representative for each section of the MAR and the MAR Secretary. Meeting materials (Draft MAR and Summary Report) are distributed to the meeting attendees and SSMA team one week prior to the scheduled Code 300 management review meeting.
- The MAR Secretary takes meeting minutes and prepares a report of any lessons learned from the MAR for future use and updates to the MAG, to be distributed to meeting attendees. The SAM prepares a report of the disposition of comments and actions from the meeting and distributes it to the attendees. Upon acceptance of this report the SAM routes the MAR through the following personnel for approval:
  - Associate Chief Code 303 - Assurance Management Office
  - Chief Code 303 - Assurance Management Office
  - Deputy Director Code 300 - Office of Systems Safety and Mission Assurance
  - Director Code 300 - Office of Systems Safety and Mission Assurance
- After completion of the approval routing, the SAM submits the MAR to the project office.



# *Content of Mission Assurance Requirements*

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The SAM shall address the following elements in the MAR:

***Quality Management System*** – compliant with Goddard Management System (ISO 9001 certified and soon to be AS9100 compliant also)

***System Safety*** – consistent with the requirements imposed by the appropriate launch range and the launch vehicle manufacturer or launch services provider

***Reliability and Maintainability*** – designed to effectively interface with other program disciplines, including systems engineering, hardware design, and product assurance

***Software Assurance*** – including requirements for Software Quality Assurance, Software Safety, Software Reliability, Verification and Validation, and Independent Verification and Validation that is commensurate with the software size, complexity, criticality, and level of risk

***Ground Data System Assurance*** – consistent with program requirements



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The SAM shall address the following elements in the MAR (cont):

***Risk Management*** – compliant with NASA and GSFC requirements

***Independent System-level and Engineering Peer Reviews*** – compliant with NASA and GSFC requirements

***Design Verification Program*** – including environmental testing tailored to reflect hardware criticality, mission objectives, hardware characteristics (e.g., physical size or complexity), and the level of risk accepted by the project

***Workmanship Standards*** – assures that electronic packaging technologies, processes and workmanship activities are selected and applied to meet mission objectives for quality and reliability

***Parts, Materials and Processes (PMP) Program*** – assures that all parts, materials and processes selected for use in flight hardware meet mission objectives for quality and reliability



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The SAM shall address the following elements in the MAR (cont'd):

***Contamination Control Program*** – assures the establishment of cleanliness requirements and approaches to control contamination within project requirements

***Electrostatic Discharge (ESD) Control Program*** – assures that all manufacturing, inspection, testing, and other processes will not compromise mission objectives for quality and reliability due to an ESD event

***Government-Industry Data Exchange Program (GIDEP) participation plan*** – detects and reports problems that affect or potentially affect the suitability of electronic parts and materials for use in GSFC products or that affect or potentially affect personnel or system safety.

**New to Code 300 Requirements:**

***THE “GOLD RULES”*** – Compliant with GSFC overarching standards for space system design, development, verification and operation.



# *Code 303 • Assurance Management Office*

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- Responsible for the development and implementation of mission assurance programs for GSFC projects. Activity starts during project formulation with the proposed mission assurance program and workforce planning. Support continues through development and implementation, culminating with tracking and support of on-orbit anomaly resolution for mission operations.
- Provides a single point of contact for project Systems Safety & Mission Assurance (SS&MA) activities via the Systems Assurance Manager (SAM). The SAM is generally co-located with the project office and functions as a member of the management team with an independent reporting path.
- Support includes managing parts and materials support, process and procedure verification, defining contractor and government surveillance requirements, hardware and software reliability/safety/quality assurance, assurance of environmental test verification, and technical system design reviews.
- Additional assurance resources are provided by Quality Engineers and Quality Assurance Specialists. The office relies on support contractors for quality engineering support. Their performance is monitored via a matrix of performance-based metrics.



# *Independent Reporting*

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- SAMs report weekly progress to OSSMA via the Weekly Report
  - This report is reviewed by Code 300 division chiefs, Code 541 (materials), Code 562 (parts), and Chief Engineer during a Monday morning table top discussion.
  - Actions, issues, etc. are recorded by the Assurance Management Office
- SAMs present status directly to the Director of and Division Chiefs bi-monthly or monthly within 6 months of launch
  - Receive technical and programmatic advice
  - Dissemination of Lessons Learned
  - Opportunity to ask for extra help
  - Opportunity to be offered help

*Backup Slides*



# *Mission Assurance Requirements*

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Mission Assurance Requirements are derived from:

- The Mission Assurance Guidelines (MAG) Implementation (300-PG-7120.2.1)
- The Mission Assurance Guidelines (MAG) for Tailoring to the Needs of GSFC Projects (300-PG-7120.2.2)
- The Procedure for Developing and Implementing Software Quality Programs (303-PG-7120.2.1B)



## *Activities/Functions within The Mission Assurance Requirements*

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- Quality Management System
  - Requirements Flow down
  - Surveillance of developer
  - Control of sub-suppliers
  - Control of nonconforming product
  - Material Review Board
  - Failure reporting
  - Control of monitoring and measuring devices
  - New on-orbit design





## *Activities/Functions within The Mission Assurance Requirements*

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- System Safety
  - Documentation
  - Deliverables
  - Assessment reports
  - Pre-launch data package
  - Ground operations procedures
  - Noncompliance/waiver requests
  - Orbital debris assessment
  - Launch site support
  - Mishap reporting



## *Activities/Functions within The Mission Assurance Requirements*

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- Reliability and Maintainability
  - Probabilistic risk assessment
  - Reliability analysis
    - Failure Modes Effects Analysis
    - Fault Tree Analysis
    - Parts Stress
    - Worst Case
    - Reliability assessments and predictions
    - Software reliability
  - Limited Life items
  - Maintainability



## *Activities/Functions within The Mission Assurance Requirements*

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- Software Assurance
  - Software Quality
  - Software Safety
  - Software Reliability
  - Verification and Validation
  - Independent Verification and Validation
  - Reviews
  - Configuration management
  - Problem reporting and corrective action
  - Government furnished equipment and purchased software
  - Status reporting
  - Surveillance of software development



## *Activities/Functions within The Mission Assurance Requirements*

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- Ground data systems requirements
  - QMS
  - Reviews
  - Assurance activities
  - Government furnished equipment, commercial-off-the-shelf, and purchased equipment/software
  - Reuse
  - Defect prevention
  - Databases
  - Security
  - Reliability and availability
  - Maintainability
  - Safety



## *Activities/Functions within The Mission Assurance Requirements*

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- Risk Management
- Integrated Independent Review
  - Mission Reviews
  - Instrument Reviews
  - Spacecraft Reviews
  - Operations Reviews
- Design Verification
  - System performance verification plan
  - Environmental verification plan
  - System performance verification matrix
  - Environmental test matrix
  - Environmental verification specification
  - Performance verification procedures
  - Verification reports
  - System performance verification report



## *Activities/Functions within The Mission Assurance Requirements*

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- Workmanship
  - Design
    - Printed wiring boards
    - Assemblies
    - Ground data systems that interface with space flight hardware
  - Workmanship
    - Training and certification
    - Flight and harsh environment ground systems workmanship
    - Ground systems (non-flight) workmanship
    - Documentation



## *Activities/Functions within The Mission Assurance Requirements*

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- Parts, Materials and Processes
  - Parts, materials and processes control boards
  - Management of PMP selection
  - Management of PMP engineering requirements
  - Management of PMP procurement
  - Radiation hardness
  - Government furnished equipment
  - Commercial off-the-shelf
  - PMP qualification
  - Failure analysis
  - Preservation and packaging
  - Handling
  - Data retention



## *Activities/Functions within The Mission Assurance Requirements*

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- Contamination Control
  - Verification process
  - Control plans
  - Material outgassing
  - Thermal vacuum bakeout
  - Hardware handling
- Electrostatic Discharge Control
- Government Industry Data Exchange Program (GIDEP) alerts and problem advisories